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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/511,912	02/23/2000	Tatau Nishinaga	JEL 31015	4100

7590 06/29/2004

Stevens Davis Miller & Mosher LLP
1615 L Street NW
Suite 850
Washington, DC 20036-4387

EXAMINER

ANDERSON, MATTHEW A

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 06/29/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

SC

Office Action Summary	Application No.		Applicant(s)	
	09/511,912		NISHINAGA, TATAU	
	Examiner		Art Unit	
	Matthew A. Anderson		1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 April 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) 7-10 and 19 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6, 11-18, 20-23 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 23 February 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 4/28/2004 has been entered.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-6, 11-18, 20-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al. (6,377,596 B1) in view of Tokunaga et al. (US 5,425,808) and Nakamura et al. (JP 01-234389A).

Tanaka et al. discloses a method of lateral epitaxial overgrowth of nitride semiconductors (i.e. III-V compound semiconductors such as GaN and alloys). In Fig. 3 the method is shown. A substrate of single crystal sapphire (1) has an amorphous insulating layer of SiO₂, Si₃N₄ (SiN_x), SiO₂:P₂O₅ (PSG), SiON, or Ta₂O₅ is grown on the

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substrate and then patterned. Nitride semiconductor material is grown epitaxially up out of the patterned opening and laterally over it (Figs. 3C-3E). Alternative substrates are given in col. 32 lines 35-37 as GaAs, InP, InAs, GaSb, GaP, GaAsP, or GaInAs.

Tanaka et al. does not use MBE as the method of nitride semiconductor growth.

Tokunaga et al. discloses prior art in which GaAs (a known III-V semiconductor compound) is laterally overgrown on an amorphous SiO₂ or Si₃N₄ film. (col. 2 lines 14-29). Tokunaga et al. suggests the equivalence of MBE (molecular beam epitaxy) and CVD (chemical vapor deposition for growth of epitaxial films. (col. 1 lines 30-35, and col. 7 lines 15-24.) Additionally, the use of such method to grow other III-V compounds (such as GaN) was also suggested in col. 7 lines 1-25.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to combine the references above because Tokanaga et al. suggests an equivalent method of growing selective epitaxial nitride films upon amorphous masking layers thus increasing process flexibility.

The above combination does not suggest the angle of incidence required by the claims.

Nakamura et al. discloses a molecular ray method of performing epitaxy with Ga, Al, and As. Nakamura et al. discloses optimization of the angle of incidence between the substrate and the molecular ray (i.e. beam). The angle can be optimized between 0-90 degrees.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to combine Nakamura et al. with the previous combination because

Nakamura et al. discloses optimization of the angle of incidence between the substrate and the molecular ray (i.e. beam) in order to positively affect the product. The motivation for combining would be the optimal crystal thereby formed.

In respect to claims 1-6, 12-13, it would have been obvious to one of ordinary skill in the art at the time of the present invention to optimize the incident angle between the substrate surface and the beam during lateral overgrowth of a single crystalline film on a patterned insulating amorphous film which lies on a single crystalline substrate from the exposed seed substrate because such is suggested by the combination of references and such optimization would have been achieved with only routine experimentation. Additionally, it would have been obvious to use an amorphous film different than the substrate since such was disclosed by Tanaka. Further, the amorphous film was, by definition, amorphous, and thus would lack dislocation density because dislocations require some crystal structure.

In regard to claim 11, it would have been obvious to one of ordinary skill in the art at the time of the present invention to form linear openings in the amorphous film of a certain width because these limitations would have been obvious design choices based on Tanaka's figures and description.

In regard to claims 14, it would have been obvious to one of ordinary skill in the art at the time of the present invention to form a single crystalline film with a defect density not more than 10^4 cm^{-2} because such is directly suggested in Tanaka et al. as possible with such an overgrowth method. (see col. 6 lines 1-10)

In regard to claims 15-16, it would have been obvious to one of ordinary skill in the art at the time of the present invention to grow films with lattice constants different from the substrate because Tanaka et al. suggests GaN can be grown on sapphire substrates which have an inherent and distinct lattice constant.

In regard to claim 17, it would have been obvious to one of ordinary skill in the art at the time of the present invention that the single crystalline substrate be of a material different than that of the beam used because Tanaka used a sapphire (Al_2O_3) single crystalline substrate and grew GaN thereon by ELO. Thus, the substrate material and the beam material may be different according to Davis.

In respect to claim 18, it would have been obvious to one of ordinary skill in the art at the time of the present invention to grow a single crystalline film epitaxially on a surface of a substrate which has a different molecular structure and is not an alloy of the single crystalline film grown thereon because Tanaka et al. grows epitaxially GaN on a sapphire substrate.

In respect to claim 20-23, it would have been obvious to one of ordinary skill to use GaAs as the single crystalline film and sapphire as the single crystal substrate because sapphire or GaAs substrates were known by Tanaka for use in selective epitaxy of III-V semiconductors of which GaAs and GaN are well known examples.

Response to Arguments

Applicant's arguments filed 3/24/2004 and 4/28/2004 have been fully considered but they are not persuasive.

In respect to arguments of 3/24/2004:

The argument that the finality of the previous rejection was improper is moot in light of the Request for Continued Examination filed 4/29/2004.

The argument that MBE and CVD are not equivalent is not convincing. Tokunaga et al. suggests this equivalency for selective epitaxial growth in col. 7 lines 15-25.

The argument that Nakamura et al. does not teach growth from 0-90 degree beam angles is not convincing. Growth occurs at angles from 0-90 albeit at different rates (see Fig. 1 and 2).

The argument In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

The arguments concerning the Nakamura reference were considered but were not convincing. The examiner notes that Nakamura Fig. 2 clearly suggests a relationship between the incidence angle of the molecular beams and the epitaxial layer composition. The examiner notes that Nakamura et al. discloses MBE occurring at

angles of beam incidence from 0 to 90 degrees. One of ordinary skill would have expected epitaxial growth to occur at these angles of incidence. The applicant has made the assumption that the optimum positive effect is by a beam directed perpendicular to the substrate. This is only if the growth rate is to be optimized. One of ordinary skill would have expected epitaxial growth to occur at these angles of incidence including at from the claimed 0-40 degrees.

The argument of a teaching away is not convincing. Nakamura clearly discloses growth at the claimed angles.

The arguments for unexpected results (page 13-14) are not convincing in light of Fig. 3A-3E of Tanaka et al.

Arguments on page 15-16 are not convincing. Tanaka discloses the growth of III-V nitrides by ELO over an amorphous patterned film. Tokunaga et al. suggests III-V semiconductor ELO over an amorphous patterned film with the stated equivalence of MBE and MOCVD for selective epitaxy. Tanaka et al. discloses the different kind of substrate than the growth material.

The arguments against the rejection of claims 20-23 are not convincing. The materials are found in the references cited. Tanaka et al. discloses the claimed substrate materials and the crystalline film materials.

In respect to arguments of 4/28/2004:

The argument that one of ordinary skill would be discouraged from the course taken by the applicant, that there is a teaching away, and that there is no suggestion to

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combine are not convincing. The first two arguments are dealt with above. The motivation to combine is found in the rejection above.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew A. Anderson whose telephone number is (571) 272-1459. The examiner can normally be reached on M-Th, 7-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MAA
June 24, 2004

NADINE C. NORTON
SUPERVISORY PATENT EXAMINER

